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2022 Takotna River Salmon Run Timing and Abundance

by

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I. ACKNOWLEDGEMENTS:

Success of the Takotna River weir would not be possible without partnership and contributions. The Takotna River weir is located on the traditional lands and waters of the Yupik, Cupik, and Athabascan Dené peoples. On behalf of Kuskokwim River Inter-Tribal Fish Commission, we thank the following companies and individuals for their support of this project that the Takotna Tribal Council has continued to support and oversee. Takotna community members and crew were dedicated to overseeing the day-to-day operation of the weir project, including Crew Leader Robert Perkins, and Fish Technicians, Alfred Perkins, John Lindermen, Michael Dopler, Dan Dopler, and Joseph Dopler. Thank you to the Alaska Department of Fish and Game for your technical expertise and generous use of the weir material and facilities.

II. ABSTRACT:

The Kuskokwim River Inter-Tribal Fish Commission, assisted by the Takotna Tribal Council and local fish technicians, monitored the escapement of Chinook salmon (*Oncorhynchus tshawytscha*) and chum salmon (*O. keta*), returning to the Takotna River, Alaska. A resistance board weir was used from July 10 to August 8, 2022, to collect abundance and run timing of both Chinook and chum salmon, slightly shorter than the traditional target period of July 1 to August 10. Age, sex, and length (ASL) data were collected from a subsample of the Chinook salmon. Data collected at the weir support management of the salmon fisheries that occur in the Kuskokwim River drainage. Observed totals of 164 Chinook salmon and 630 chum salmon passed the weir during the target period of July 10 to August 18, 2022. Because the number of days of weir operation in 2022 was less than 60% of the range of days for historical weir operation, 2022 weir counts were not extrapolated to account for days in which the Takotna weir was not operational, including days before and after weir installation. The midpoint of observed cumulative 2022 passage was July 15 for Chinook salmon and July 24 for chum salmon. The predominant Chinook salmon ages were age 1.2 from the 2018 brood year for both males and females. Females comprised an estimated 48% of the weir passage of Chinook salmon in 2022. Mean lengths were 623.8 millimeters (mm) for female Chinook salmon and 554.7 mm for males. No Chinook salmon sampled for ASL data were larger than 800 mm.

III. INTRODUCTION:

The Kuskokwim River historically supported the largest subsistence salmon (*Oncorhynchus* spp.) fishery in the state of Alaska, in both the number of residents who participate in the fishery and the number of salmon harvested (Fall et al. 2012). With some of the lowest per capita monetary incomes in the United States, subsistence use in this region is extremely important and is characterized by a high production of wild foods for local use (Wolfe and Walker 1987). In recent decades, residents of the Kuskokwim region have annually harvested over 360 pounds of wild foods per person for human consumption, with fish comprising up to 85% of the total poundage of subsistence harvests, and salmon contributing up to 53% of subsistence harvests (Simon et al. 2007; Wolfe et al. 2011). Residents harvest all five species of Pacific salmon: Chinook (*O. tshawytscha*), chum (*O. keta*), coho (*O. kisutch*), pink (*O. gorbuscha*), and sockeye (*O. nerka*). The importance of salmon, particularly Chinook salmon, to local residents extends beyond nutrition and economic values, and includes sociocultural and personal identities (Ikuta

et al. 2013). Kuskokwim River Chinook salmon stocks have been in a period of low productivity since 2007, requiring significant subsistence fishing restrictions to meet established escapement goals. Since 2011, subsistence harvests of Chinook salmon from the Kuskokwim River drainage have been below the Amounts Reasonably Necessary for Subsistence (ANS) for the Kuskokwim River, designated by the Alaska Board of Fisheries as the range of 64,500-83,000 fish during 2001–2012 and 67,200–109,800 fish beginning in 2013 (McDevitt and Koster 2022; Smith and Gray 2022; Smith et al. 2022). Since 2019, estimated subsistence harvests of chum salmon in the Kuskokwim River have been below the ANS range, designated by the Alaska Board of Fisheries, of 41,200–116,400 fish (McDevitt and Koster 2022; Smith and Gray 2022; Smith et al. 2022).

A weir has been operated on the Takotna River for 20 years (2000–2013 and 2017–2022) as an upper Kuskokwim River index for salmon escapement (Figure 1). During 1995–1998, enumeration of the Takotna River salmon escapement was estimated using a counting tower. Tower operation employed students and staff of Takotna Charter School and Training Center with assistance from Alaska Department of Fish and Game (ADF&G). However, tower operations were only considered successful in 1996 and 1997 as water conditions impeded accurate counting of salmon passage in other years (Molyneaux et al. 2000). Beginning in 2000, a resistance board weir has been operated with a live trap, to allow enumeration and collection of biological data from passing fish, including during most high-water conditions with poor visibility (Williams and Blain 2013; Whitworth and Bechtol 2022).

Following the lowest escapement of Chinook salmon to the Takotna River ever documented in 2013, combined with budget cuts and revised assessment priorities, ADF&G withdrew funding of this project beginning in 2014. Unfortunately, 2012–2014 also produced the lowest total Chinook salmon returns ever estimated for the Kuskokwim River drainage (Larson 2022). In response, regulatory changes adopted in 2016 closed salmon fishing during the early portion of the Chinook salmon spawning run, with the understanding that most of these early fish are upstream spawners (Clark and Smith 2019). However, there are few upstream spawning tributaries with an extended history of weir operation to assess the effects of the early season closures and/or to assess the status of small stocks. The importance of small/weak stocks is becoming increasingly recognized for maintaining diversity and productivity in large river systems (Connors et al. 2020, 2022). The Takotna River weir is the only upriver tributary with a long-term data series suitable for evaluating the effects of the early season closures on headwater stocks.

Recognizing the importance of this project, the Takotna River weir was re-established in 2017 to measure Chinook salmon returns. The project historically operated as a community-based project with strong involvement from local villages to build local capacity and increase participation of upper Kuskokwim River stakeholders in the Chinook salmon management process. The weir project is designed to continue with this approach, under administrative oversight by the Kuskokwim River Inter-Tribal Fish Commission (KRITFC) and with support from the Takotna Tribal Council.

IV. OBJECTIVES:

The overarching project goal is to continue a long-term ground-based project that will adequately index salmon escapement to the headwater tributaries of the Kuskokwim River. By continuing the only long-term data set dedicated to evaluating salmon escapement to a Kuskokwim River headwater tributary, including continuing the time series of environmental data, this project provides local residents, researchers, and managers with data and insights for understanding the local impacts of climate change and fishery management practices. Specific project objectives include:

- Enumerate the daily passage and characterize the run timing of Chinook salmon through the resistance board weir from July 1 to August 10.
- Enumerate the daily passage and characterize the run timing of chum salmon and resident fish species through the resistance board weir from July 1 to August 10.
- Estimate the weekly sex and age composition of Chinook such that the simultaneous 95% confidence intervals have a maximum width of 0.20.
- Collection of environmental data (air/water temperature, flow volume, precipitation, etc.).
- Serve as a platform to develop local talent/capacity in a community-based stock assessment project and conduct community outreach.
- Serve as a platform for future research projects such as tagging studies, heat-stress, collection of genetics data, and monitoring of environmental data.

V. METHODS:

1. Project Area:

Originating in the central Kuskokwim Mountains of the upper Kuskokwim River, the Takotna River (Figure 1) is formed by the confluence of Moore Creek and Little Walden Fork (Brown 1983). From this confluence, the Takotna River flows northeast, passing the community of Takotna at river kilometer (rkm) 80 (river mile [rm] 50), before turning southeast near the confluence with the Nikon Fork at rkm 24 (rm 15). The Tatalina River enters the Takotna at rkm 5 (rm 3), and then the Takotna River merges with the Kuskokwim River across from McGrath at rkm 752 (rm 467) from the mouth of the Kuskokwim River. The Takotna River is about 160 km (99 miles) long with a drainage of 5,646 square kilometers (2,180 square miles).

The Takotna River region has a sub-arctic climate characterized by extremes in temperature. Summer temperatures average 6 to 27 ˚C (42 to 80 ˚F), whereas winter temperatures average -18 to 6 ˚C (0 to 43 ˚F). Average yearly precipitation is approximately 30.5 centimeters (cm) (12 inches), with the majority falling between June and October. The rivers in this area generally become ice-free in the slow current sections by early May and freeze over during November.

During 2000–2013, and 2017–2021, the Takotna River weir was installed at 62°58.0' N., 156°05.9' W., a site several hundred meters above the Takotna River bridge near the community of Takotna (Williams and Blain 2013) and about 17 air miles west of McGrath

(Figure 1). The location provides for enumeration of most salmon spawning in the Takotna River drainage, excluding the Nixon Fork tributary returns. At the Takotna River weir site, the river channel is about 85 meters (279 feet) wide and less than 1 meter (3 feet) deep during normal summer flows, with a substrate of gravel mixed with some sand and cobble. Non-salmon species commonly found at this location include Arctic grayling (*Thymallus arcticus*), whitefish (*Coregonus spp.*), northern pike (*Esox lucius*), and longnose suckers (*Catostomus catostomus*).

2. Project Design:

All salmon passing upstream through the weir were counted to achieve a complete visual count of escapement during operations. Counts, by species as they passed, were made daily. The timing and number of counting sessions were adjusted in-season depending on the timing and abundance of fish passing through the weir (Molyneaux et al. 2010). The historical target operational period was July 1 through August 10.

A resistance board weir was installed across the entire 85-meter channel following the techniques described by Stewart (2003) and employed in prior years at this site. Weir installation is targeted for mid-June during a typical low water period. The weir has two sectional components: (1) a substrate rail and resistance board panels placed in the middle 75-meter portion of the channel; and (2) fixed weir materials (picket fence) installed from the stream bank to the floating panels. The floating and fixed weir lengths were adjusted as needed to accommodate river width and depth. Specific details of the design and materials for weir construction are provided by Tobin (1994), with panel modifications as presented by Stewart (2003). The Takotna River weir design applied a 4.29 cm (1 11/16 in) gap between pickets, which is enough to stop all adult salmon, except pink salmon, from upstream migration (Williams and Blain 2013). A live trap and skiff gate were incorporated into the weir structure at the deeper portion of the channel. The live trap was set to either allow fish to freely pass upstream while being counted, or to retain fish for collection of age, sex, and length (ASL) samples. The skiff gate allows boat operators to pass with little or no involvement of the weir crew, while minimizing or preventing passage of migrating salmon during boat passage.

During the period of weir operation, several non-salmon species (e.g., longnose suckers) migrate downstream. To provide for such migrations, "downstream passage chutes" were established by releasing the resistance boards on a pair of adjacent weir panels so that the downstream ends of the panel settled slightly below the water surface. The weir crew monitored and adjusted these chutes as needed to ensure downstream migrant passage while preventing upstream migration of adult salmon.

The composition of spawning Chinook salmon (escapement quality) was estimated by sampling salmon retained by the live trap. Sampling techniques were consistent with standard methods described by Molyneaux et al. (2010), using a conventional fish trap design described by Linderman et al. (2002). Chinook salmon escapement was sampled daily, approximately in proportion to observed passage abundance.

Climatological, stage height, and air and water temperature data were collected and recorded daily. Stream gage stage height was measured and recorded each morning at 0900 hours.

3. Data Collection and Reduction:

a. Escapement Monitoring

Historically, the weir was used to assess most Takotna River salmon runs, including coho salmon which have a later run timing than other species. But similar to the past four years, the 2022 Takotna River weir objectives have been focused on enumerating Chinook and chum salmon escapements. To achieve the objectives, July 1 to August 10 remained the target operational dates. These data continued the 21 plus years of Takotna River Chinook and chum salmon escapement estimates.

During the operational period, weir crews recorded daily and cumulative escapements by salmon species including estimated passage missed due to weir problems. The weir was inspected daily for holes and the potential for fish passage documented. Weir panels were cleaned daily, or as needed, of carcasses and debris. Carcasses were identified, and daily counts recorded by species and sex.

Counts of passing fish were made at a frequency of four to eight shifts per day between 0700 and 2400 hours. Counting effort increased during times of higher fish passage, regardless of fish species, to reduce stress to fish being held in the weir live trap. During counting, a crew member opened the passage gate to allow fish to pass freely. The crew member then identified each fish being passed upstream by species, and the count was recorded on a multiple tally counter. The crew ensured the passage gate was securely closed at the end of a counting shift.

b. Age, Sex, and Length Composition

Collection of ASL data is crucial to evaluating the composition of salmon returning to any stream, and how management strategies and escapement composition may interact to affect long-term productivity within environmental constraints. Per Bromaghin (1993), ASL samples should be collected from a minimum of 190 Chinook salmon passing through the Takotna weir, assuming 10 age-sex categories, an unknown population size, and 95% confidence intervals for each age-sex bin. The Takotna River presently supports a relatively small population of Chinook salmon and counting tower/weir counts ranged from 104 to 1,197 during 1996-2021, with a historical average escapement of 402 Chinook salmon. The smallest observed escapement, 104 Chinook salmon, occurred in 2013 (Larson 2022). While there are indications of improved returns in recent years, the rate of improvement was slower than the increases following historical declines. Therefore, it was anticipated that ASL samples should be collected from as many of the Chinook salmon being passed through the weir as was reasonable and prudent.

Chinook salmon used for ASL sample collections were captured from the weir live trap. During weir operation, salmon migrating upstream pass the entrance gate while the exit gate is closed. A V-shaped entrance gate prevents fish from easily returning downstream. The live trap was allowed to fill with fish until a reasonable number was inside. Weir crew members removed fish from the live trap using a short-handled dipnet, and fish were placed in a partially submerged fish "cradle." Scales were removed from the preferred area of the fish (INPFC 1963) and transferred to numbered gum cards as described in Molyneaux et al. (2010). Sex was determined through visual examination of

the external morphology, focusing on the prominence of a kype, roundness of the belly, and the presence or absence of an ovipositor. Length (mid-eye to tail fork; nearest millimeter [mm]) was measured with a straight-edged meter stick. Sex and length data were recorded on standardized numbered data sheets that correspond to numbers on the gummed scale cards. Immediately after sampling, fish were released upstream of the weir and the process repeated until the live trap was empty. At the end of a sampling session, data on sampling date, sampling location, sex, length, and corresponding gum card numbers were transferred to an Excel spreadsheet. Salmon scales were cleaned and properly affixed to gummed scale cards. Scale cards were completed according to ADF&G procedures for the Kuskokwim Area (Buklis 1985; Merritt 1987).

Subsequent scale analysis and reporting by ADF&G followed methods described by Mosher (1969). Age determinations for Chinook salmon include the number of years spent in freshwater as a juvenile and the number of years spent in saltwater. The ASL data were archived within the Alaska-Yukon-Kuskokwim-Database Management System[1] by ADF&G staff.

c. Environmental Monitoring

Environmental data were recorded in a designated logbook at approximately 0900 and 1700 hours daily with water temperature (°C) first recorded on the evening of July 11 and air temperature (°C) on the morning of July 12, with recordings extending to the completion of weir operations on August 8. Additional information included wind direction, wind speed, cloud cover, precipitation, and river depth. Precipitation (in mm) was recorded based on a rain gauge. River depth was determined using a standardized gauge consisting of a metal rod driven into the stream channel with a meter stick attached. The gauge was calibrated to a semi-permanent benchmark that corresponded to a stage measurement of 300 cm (Williams and Blain 2013).

4. Data Analysis:

Daily escapement counts and ASL data underwent a standardized post-season quality control review. Estimates of missed upstream passage of Chinook salmon for days in which the weir was inoperable or incomplete due of delayed installation, flood events, or minor structural damage typically involve a Bayesian analysis (Dickerson et al. 2019). But estimates of missed passage were not made for 2022 because the threshold of 60% of historical weir operating days was not met. Daily averages were calculated for water temperature and water stage data. Age and size composition data for dates when no ASL samples were collected were estimated from weekly compositions for available passage dates.

Project Monitoring and Evaluation:

The two primary objectives of this project are to operate a resistance board weir to count passage of Chinook and chum salmon during the period of July 1 to August 10, and to collect ASL data from Chinook salmon passing the weir. The project is deemed successful if the weir is operated by local hire technicians with a minimum of down time due to environmental conditions, and counts of fish passage are obtained by species. This information was summarized for

[1] https://www.adfg.alaska.gov/CF_R3/external/sites/aykdbms_website/Default.aspx

consideration during the inseason decision processes by fishery managers and advisory groups. The secondary objective of collecting Chinook salmon ASL data will be deemed successful if up to 190 ASL samples are collected, contingent on the magnitude of the Chinook salmon escapement return. The ASL data will be used as input data into postseason stock assessment models. Collection of environmental data during the period of weir operation will provide a synopsis of conditions during the spawning season, but will also serve as a basis for interannual comparisons to document the effects of climate change.

VI. RESULTS:

Weir Operation:

In 2022, the Takotna River weir crew started preparing the weir and setting up camp on June 16. The crew consisted of seven local hires from the community of Takotna. Due to equipment issues, the weir was not fully installed until late on July 10. Due to a threatened evacuation because of a local wildfire, the weir passage gate was opened late on July 13 and no fish counts made until late in the day on July 14. The weir was fish tight from July 14 until July 18–20 when high-water and debris conditions partially or totally impeded weir operation. Holes in the weir, likely related to debris during continued high water, were present during 4–6 hours on July 22 and 6–8 hours on July 23. The weir remained fish tight from July 24 through August 8, and was dismantled starting on August 11.

Environmental Data:

The average water level recorded was 83.0 cm between July 10 and August 8. The highest water levels were 100.0 cm on August 8 and 99.5 cm on July 19. The lowest water level was 61.0 cm on July 15. The average daily water temperature (averaged between morning and evening readings) was 12.9 ˚C (Figure 2). The highest water temperature recorded in the morning was 19 ˚C on July 13, and in the evening was 20 ˚C on July 12. The lowest water temperature in the morning was 8˚C on July 28, and in the evening was 7 ˚C on July 27. Average air temperatures recorded in the morning and evening were 10.4 ˚C and 16.6 ˚C, respectively. The warmest air temperature recorded in the morning was 18 ˚C on July 13, and in the evening was 28 ˚C on July 231. The lowest air temperature in the morning was 4 ˚C on August 7, and in the evening was 9 ˚C on July 18 and 20 and August 7 and 8.

Biological Data:

Chinook Salmon – The weir was first fish-tight late on July 10, with the first full day of weir operation considered to be counts on July 11. A total of 164 Chinook salmon were counted past the weir location during July 11 through August 8, 2022 (Table 1). But it is recognized that this is a minimum estimate given missed or partial days of weir operation. A Bayesian statistical analysis to estimate weir counts of Chinook salmon for partial or missed days during the historical run period requires that 60% of the historical July 1 to August 10 dates be covered by full weir counts (Adkison and Su 2001; S. Larson, ADF&G, per. com.). Because the 60% threshold was not met during 2022 weir operations, revisions were not made for missing or

partial days. The peak weekly passage (measured as Sunday to Saturday) of 104 Chinook salmon occurred July 10–16, and the midpoint of passage occurred on July 15.

Chum Salmon – An observed total of 630 chum salmon passed the weir during July 10 to August 8, 2022 (Table 1). No estimate of were made for missing or partial days of passage. The first chum was observed on July 10 and the last on August 8. The peak weekly passage of 192 Chum salmon occurred July 24–30, and the midpoint of passage occurred on July 24.

Sockeye Salmon – Only 4 sockeye salmon were counted past the weir during July 10 to August 8, 2022, with all sockeye observations occurring in August (Table 1).

Coho Salmon – No cohoh salmon were observed at the Takotna River weir during July 10 to August 8, 2022 (Table 1).

Age, sex, and length data were collected from 80 Chinook salmon (no ASL data were collected from chum salmon). Sex was identified for all 80 samples, and 63 samples produced a readable scale. Data were not extrapolated beyond the successful days of weir coverage. Four age classes (1.1, 1.2, 1.3, and 1.4) were identified from scale samples (Table 2). The predominant age class was 1.2 for both males and females. After weighting the estimated passage by the ASL samples where age and sex were available, females comprised of 53% of Takotna River Chinook salmon return. The mean length, after weighting by age class and weekly passage, was 623.8 mm for females and 554.7 mm for males. Four of the Chinook salmon sampled for ASL measured larger than 800 mm; all were female, and none were larger than 900 mm. Of the age-6 Chinook salmon identified, eight were females ranging from 680 to 844 mm in length, and three were males ranging from 735 to 760 mm in length.

Other Species – Other migrant and resident fish species counted during the weir operational period from July 12 through August 10, 2021, included 34 sockeye salmon and 37 coho salmon.

VII. DISCUSSION:

The Takotna River weir project was generally successful in meeting the goals and objectives within environmental complications. The Chinook and chum salmon resistance board weir was fully installed and operational on July 10 (instead of July 1) due to high water, and operated through August 8, except for July 18–20 when high water prevented weir operation. Takotna River Chinook and chum salmon escapement and escapement quality data were collected and delivered to ADF&G, processed, archived, and distributed to interested parties. The 2022 Chinook salmon passage of 164 fish was the third lowest in the Takotna weir history, but is an underestimate due to an inability to meet the threshold of weir operations during at least 60% of the historical coverage dates. This 2022 Takotna weir count was 56% less than the average escapement of 406 fish during 1996–2021 (Figure 3; Whitworth 2021; Whitworth and Bechtol 2022). The passage of 630 chum salmon in 2022 was the second lowest in the past two decades, exceeding only the passage of 151 chum salmon in 2021. While again an underestimate due to missed or partial weir coverage days, the observed 2022 escapement was 86% less than the average escapement of 4,629 fish during 1996–2021 (Figure 3). However, a clear concern remains over chum salmon that have generally declined in the past decade, and uncertainty over

Chinook salmon that show improvement over the past decade but are still highly variable and below the long-term average return. .

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Table 1. Daily, cumulative (Cum), and cumulative percent (%) passage for Chinook, sockeye, chum, and coho salmon at the Takotna River weir, 2022.

	Chinook			Chum			Sockeye			Coho		
Date	Daily	Cum	%	Daily	Cum	%	Daily	Cum	%	Daily	Cum	%
7/10	0			3	3	0	0	0	0	0		
7/11	15	15	9	20	23	4	0	0	0	0		
7/12	22	37	23	16	39	6	0	0	0	0		
7/13	29	66	40	32	71	11	0	0	0	0		
7/14	2	68	41	5	76	12	0	0	0	0		
7/15	23	91	55	23	99	16	0	0	0	0		
7/16	13	104	63	19	118	19	0	0	0	0		
7/17	14	118	72	17	135	21	0	0	0	0		
7/18	7	125	76	6	141	22	0	0	0	0		
7/19		125	76		141	22		0	0			
7/20		125	76		141	22	0	0	0	0		
7/21	2	127	77	37	178	28	0	0	0	0		
7/22	5	132	80	38	216	34	0	0	0	0		
7/23	4	136	83	61	277	44	0	0	0	0		
7/24	7	143	87	40	317	50	0	0	0	0		
7/25	2	145	88	36	353	56	0	0	0	0		
7/26	0	145	88	30	383	61	0	0	0	0		
7/27	2	147	90	29	412	65	0	0	0	0		
7/28	3	150	91	18	430	68	0	0	0	0		
7/29	8	158	96	17	447	71	0	0	0	0		
7/30	0	158	96	22	469	74	0	0	0	0		
7/31	0	158	96	13	482	77	0	0	0	0		
8/1	1	159	97	20	502	80	1	1	25	0		
8/2	2	161	98	24	526	83	0	1	25	0		
8/3	0	161	98	19	545	87	0	1	25	0		
8/4	1	162	99	8	553	88	1	2	50	0		
8/5	0	162	99	18	571	91	0	2	50	0		
8/6	0	162	99	16	587	93	0	2	50	0		
8/7	2	164	100	18	605	96	1	3	75	0		
8/8	0	164	100	25	630	100	1	4	100	0		
Weir	164			630			4			0		
Total	164			630			4			0		

Notes:

Shaded dates are when n the weir did not operate for all or part of a day.

Counts are not expanded for missing or partial days.

Boxes show the dates when 25, 50, and 75 percent of the total observed escapement passed.

Table 2. Kuskokwim River Chinook salmon age, sex, and length (mm) composition after weighting ASL samples to the total passage (n=164) from the Takotna River weir escapement project, 2022.

		2019			2018			2017			2016				
Age		1.1			1.2			1.3			1.4			Total	
		N	%		N	%		N	%		N		%	N	%
Expanded															
Male		0	0.0		55	33.7		16	10.0		5		3.2	76	46.9
Female		1	0.9		53	32.8		14	8.8		17		10.6	86	53.1
Total		1	0.9			66.5		21	18.7		22		13.9	318	100.0
Size															
Male					522.3			649.5			738.0			554.7	
Female		481.0			623.8			709.6			766.2			623.8	
Total		481.0			540.2			677.6			64.2			592.3	

Note: not all ASL data very available from each sample.

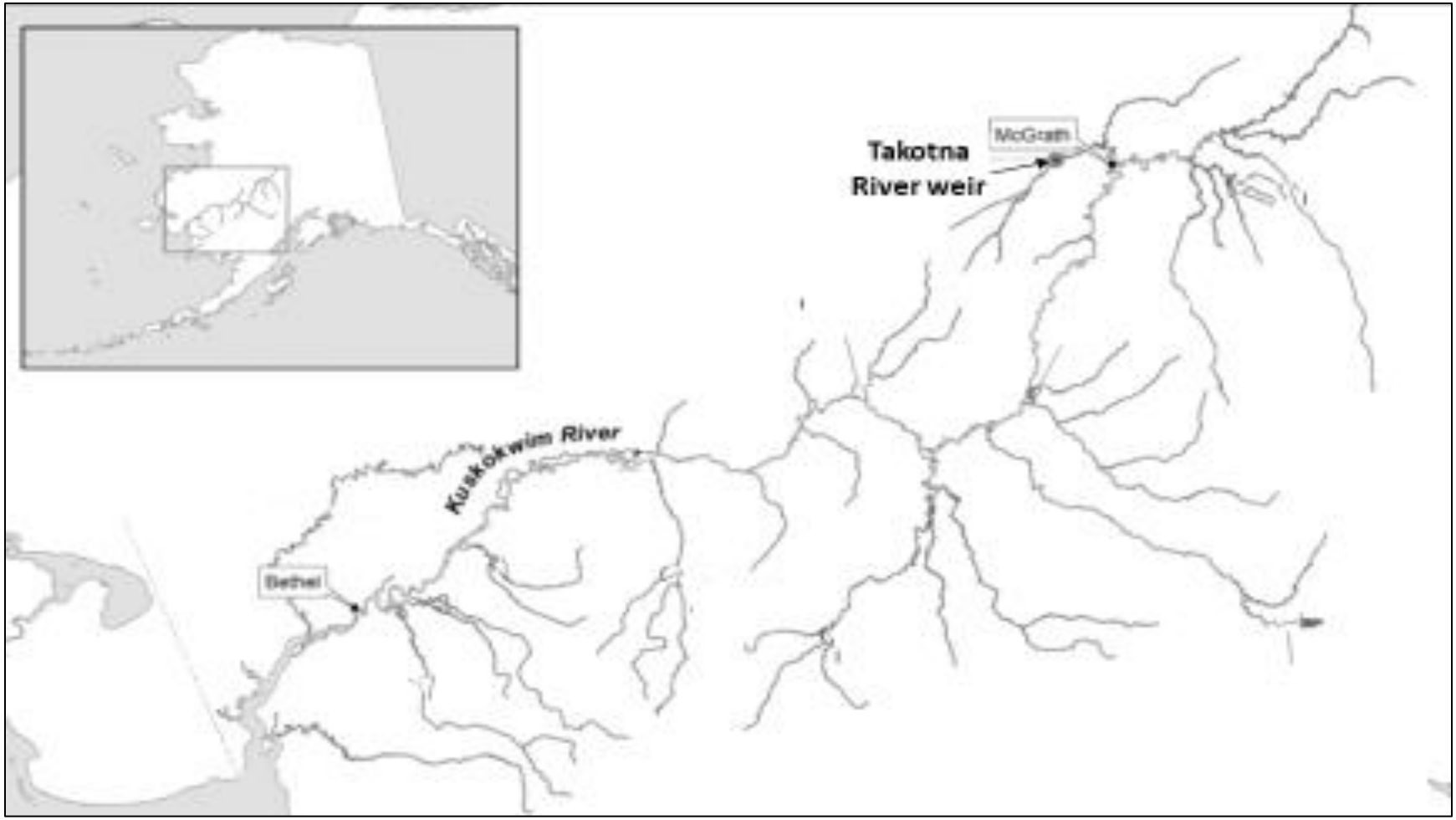

Figure 1. Location of the Takotna River weir project on the Upper Kuskokwim River.

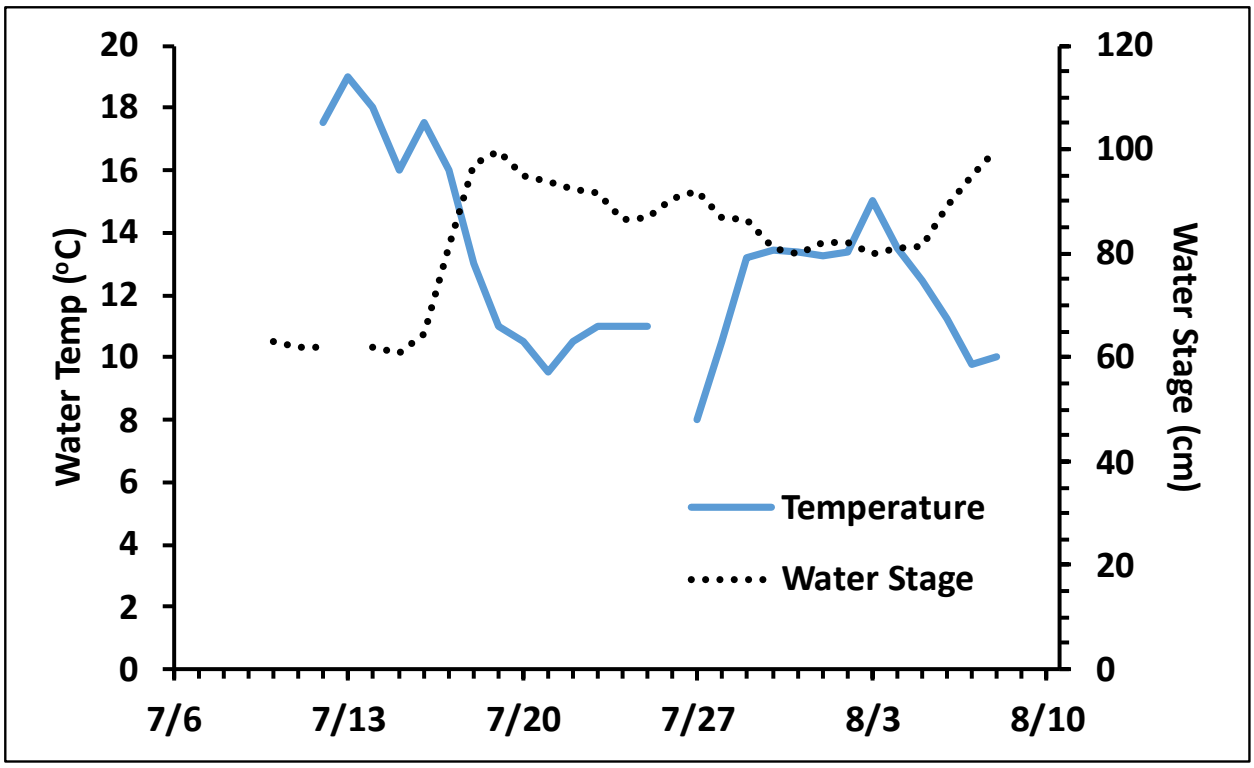

Figure 2. Average daily water temperature (°C) (solid line) and water stage (cm) (dotted line) recorded at the Takotna River weir, 2022.

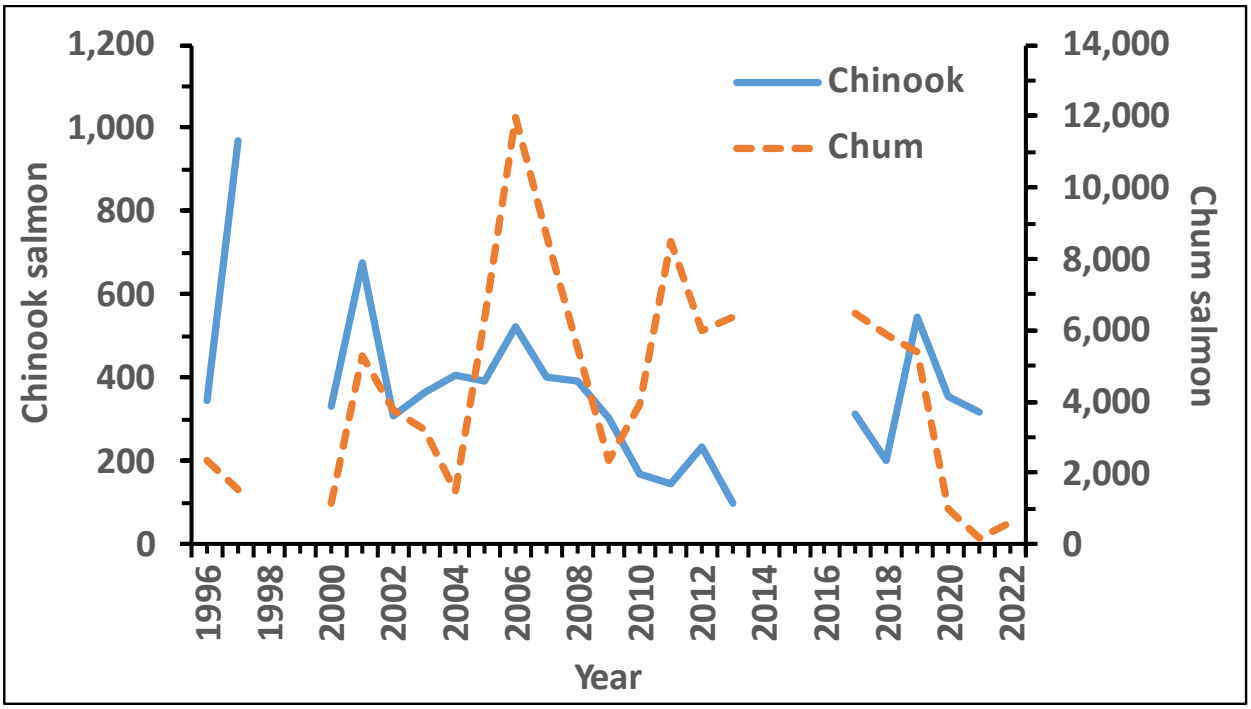

Figure 3. Annual escapements of Chinook and chum salmon to the Takotna River, 1996–2022.